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ABSTRACT

Current methods for teaching reading comprehension tend to emphasize the products of comprehension and neglect the processes of comprehension. There are two sets of skills that are particularly important to teach. The first set includes comprehension monitoring skills that involve readers' monitoring their continuing processing for possible comprehension failure and taking remedial action when failures occur. Comprehension failures can occur at various levels, including: particular words, particular sentences, relations between sentences, and relations between larger units. For each kind of failure, there are specific remedial actions readers can take. The second set of processing skills that can be taught involves using clues in the text to generate, evaluate, and revise hypotheses about current and future events in the text. In teaching these processing skills, the teacher should first model these skills by reading and thinking aloud and then gradually turn over the processing responsibilities to the students. (Author/HKM)

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TEACHING THE PROCESS
OF READING COMPREHENSION

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Teaching the Process of Reading Comprehension

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Abstract

Current methods for teaching comprehension tend to emphasize the products of comprehension, and neglect the processes of comprehension. There are two sets of processing skills that we think are particularly important to teach. The first set includes comprehension monitoring skills, which involve the reader's monitoring of his or her ongoing processing for possible comprehension failures, and taking remedial action when failures occur. Comprehension failures can occur at various levels, including: particular words, particular sentences, relations between sentences, and relations between larger units. For each kind of failure, we specify possible remedial actions the reader can take. The second set of processing skills that we advocate teaching involve using clues in the text to generate, evaluate, and revise hypotheses about current and future events in the text. We consider hypotheses about event expectations (often based on the traits and goals of the text characters); text-structure expectations (based, for example on genre); and other interpretive skills, like determining the main points. Finally, we propose that in teaching these processing skills, the teacher first models the skills, and then gradually turns over the processing responsibilities to the students.

Introduction

The cognitive approach to education assumes that if we can specify in enough detail the tacit processes that underlie various thinking skills, then we can find methods to teach students to master these skills. In this paper we focus on one critical domain -- reading comprehension -- and attempt to specify the thinking skills required together with interactive methods for teaching these skills.

Reading comprehension is usually taught in schools in one of two ways. One method is to have students read a text, and then read comments or answer questions about the text. The comments and questions can range over a variety of topics, from what particular words mean to the main point of the whole text. This method stresses important components of reading comprehension, but treats them purely as products (i.e., interpretations) rather than as processes (i.e., constructing interpretations). In particular, it does not teach students what to do when they have difficulty comprehending parts of the text; nor does it teach them how to construct and revise hypotheses about what is likely to occur in the text based on what they have already read. Both of these aspects are important in constructing an interpretation of the text.

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The other common method for teaching reading comprehension is the reading group. In a reading group, children take turns reading aloud. The teacher usually helps out when the student has difficulties, and sometimes comments or asks a question about the text. This method goes some way toward teaching the process of reading comprehension, but typically the teacher deals only with low-level difficulties (word and parsing difficulties) and asks questions only about interpretations. The method that we will propose incorporates aspects of both of the common methods, elaborated to include a much richer set of comments and questions. It is akin to the process-oriented curricula now used, such as the ReQuest and DRT methods (Tierney, Readence, & Dishner, 1980).

There are two aspects of comprehension processes that we think are important to teach: (1) comprehension monitoring, and (2) hypothesis formation and evaluation. The notion of comprehension monitoring comes out of the recent research on metacognition (e.g., Brown, 1978; Flavell, 1978; Markman, 1979). Comprehension monitoring concerns the student's ability both to evaluate his or her ongoing comprehension processes while reading through a text, and to take some sort of remedial action when these processes bog down. In the next section, we will detail the kinds of comprehension

difficulties students should learn to look for, and the kinds of remedial actions they should learn to take.

In addition to comprehension monitoring skills, students also need to be able to use clues in the text to make hypotheses about what is happening or is likely to happen next, to evaluate these hypotheses as new evidence comes in, and to revise them should evidence accumulate to indicate that they are wrong. The role of hypothesis formation and revision is central to recent artificial intelligence approaches to comprehension processes (Brown, Collins, & Harris, 1978; Bruce & Newman, 1978; Collins, Brown, & Larkin, 1980; Rubin, Bruce, & Brown, 1976; Schank & Abelson, 1977; Wilensky, 1978, in press). We distinguish between two basic kinds of hypothesis formation skills: making interpretations of the text vs. making predictions about what will happen in the text. These two are often intertwined, however. In a subsequent section, we will try to enumerate the kinds of hypotheses and expectations that seem particularly valuable for reading comprehension.

All of the preceding is concerned with what readers need to learn, not how they should be taught it. As an answer to the how issue, in the final section of this paper, we propose a method that starts with the teacher modelling to students

the above two aspects of comprehending -- comprehension monitoring and hypothesis formation. This modelling can be viewed as running a kind of "slow motion" film of the way comprehending takes place in a sophisticated reader. Gradually this process should be turned over from the teacher to the students so that they internalize these same reading strategies.

To reiterate, the next two sections of this paper detail the skills involved in comprehension monitoring and hypothesis formation and testing; the final section describes the method we propose for teaching students to develop these skills. One point to keep in mind throughout is that the skills we discuss are those needed when reading for depth and detail. Other kinds of reading -- e.g., skimming or just trying to get the main points -- may require only a subset of the proposed skills, or conceivably even a different set entirely.

Comprehension Monitoring

Comprehension monitoring skills range from handling local word-level failures to global text-level failures. Table 1 shows our taxonomy of possible comprehension failures. There are four basic types. They include failures to understand (a) particular words, (b) particular sentences, (c) relations between sentences, and (d) how the text fits together as a

whole. Each type of failure can in fact have ramifications at more global levels. We will discuss each kind of failure along with certain remedies that students should learn to take.

Failure to Understand a Word

The simplest kind of problem occurs when the reader does not understand a word, either because it is novel, or because its known meaning does not make sense in the current context.

Failure to Understand a Sentence

There are several different ways a reader can fail to understand a sentence. One possibility is that he or she fails to find any interpretation at all. Another is that the only interpretation found is so abstract as to seem hopelessly vague. (Somewhat surprisingly, this seems to be a common occurrence in scientific and technical texts.) Alternatively, the reader may find several interpretations, because of some semantic or syntactic ambiguity. A fourth problem occurs if the reader's interpretation conflicts with his or her prior knowledge.

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Table 1

Taxonomy of Comprehension Failures

1. Failure to understand a word
 - a. Novel word
 - b. Known word that doesn't make sense in the context
2. Failure to understand a sentence
 - a. Can find no interpretation
 - b. Can only find vague, abstract interpretation
 - c. Can find several possible interpretations (ambiguous sentence)
 - d. Interpretation conflicts with prior knowledge
3. Failure to understand how one sentence relates to another
 - a. Interpretation of one sentence conflicts with another
 - b. Can find no connection between the sentences
 - c. Can find several possible connections between the sentences
4. Failure to understand how the whole text fits together
 - a. Can find no point to whole or part of the text
 - b. Cannot understand why certain episodes or sections occurred
 - c. Cannot understand the motivations of certain characters

Failure to Understand How One Sentence Relates to Another

One kind of failure that can occur at the intersentence level is when an interpretation of one sentence is inconsistent with that of another. Monitoring for such inconsistencies is clearly an ability that develops with experience. Markman (1979) found that sixth-graders were far better than third-graders in detecting explicit contradictions in text. In this experiment, even the older children were surprisingly poor at detecting inconsistencies. And experimental work by Baker (1979a) suggests that even college students have trouble monitoring for inconsistencies.

In addition to inconsistencies, there are two other kinds of failures that can occur at the intersentence level: the reader can find no connection between two sentences that by juxtaposition should be related, and the reader can find several possible connections between two sentences (i.e., there is an ambiguous relation between the two sentences).

Failure to Understand How the Entire Text Fits Together

There are a number of failures that can occur at more global levels. These include failures to understand the point of the text or some part of it, failure to understand why certain episodes or sections were included, and failure to

understand the motivations of one or more characters in the text. We have analyzed in detail elsewhere the kinds of strategies sophisticated readers use to reinterpret a text (Collins, Brown, & Larkin, 1980).

Remedies and Their Triggering Conditions

There are a number of actions readers can take if they fail to understand a word or passage. We have listed possible remedies below roughly in the order of increasing disruptiveness to the flow of reading. There is a cost to any but the first option: the more drastic the action taken, the more you lose the thread of what you are reading. Therefore, more disruptive actions require more justification in terms of potential benefit. This is captured by the triggering conditions for an action, some of which are indicated in the description of each action. The triggering conditions are partially determined by the type of failure and partially by the costs and benefits of taking any action.

(1) Ignore and read on. If the word or passage is not critical to understanding, then the most effective action is to ignore it. For example, failures within descriptions and details usually can safely be ignored. If the reader fails to

understand a large proportion of the text, this is evidence that the "ignore and read on" strategy is not working.

(2) Suspend judgment. This is a wait and see strategy that should be applied when the reader thinks the failure will be clarified later. For example, new words or general principles are often explained in subsequent text. The structure of the text should tell the reader when an idea is likely to be clarified later. If it is not, it may be necessary to go back and reread.

(3) Form a tentative hypothesis. Here the reader tries to figure out from context what a word, sentence, or passage means. The hypothesis may be a partial hypothesis or a quite specific hypothesis. It acts as a pending question (Collins, Brown, Morgan, & Brewer, 1977) that the reader tests as he or she continues reading. This is a particularly useful strategy to apply if a statement is abstract or vague, or if an unknown word is fairly central and there are clues to its meaning.

(4) Reread the current sentence(s). If the reader can not form a tentative hypothesis, then it often helps to reread the current sentence or sentences, looking for a revised interpretation that would clarify the problem. This is especially useful if the reader perceives some contradiction or several possible interpretations. But it is a fairly disruptive remedy.

(5) Reread the previous context. Jumping back to the previous context is even more disruptive to the flow of reading. But if there is a contradiction with some earlier piece of the text or the reader is overloaded with too many pending questions, then jumping back and rereading is the most effective strategy.

(6) Going to an expert source. The most disruptive action the reader can take is to go to an outside source, such as a teacher, parent, dictionary, or other book. But this is sometimes required, for example when a word is repeatedly used and the reader cannot figure out what it means, or when a whole section of text does not make sense.

Several points are worth emphasizing about these remedies. First, some of these remedies correspond to strategies that college students report they use when they run into comprehension problems (Baker, 1979a). So we have some evidence that our remedies are indeed useful to skilled readers. Second, the order in which the remedies are listed roughly corresponds to the order in which we think they should be tried. In particular, the latter strategies are quite disruptive (you have to stop reading for at least a few seconds), so they should usually be the last remedies tried. Third, it is important to teach the triggering conditions that can clue the reader when to give up on one remedy and try another. Finally, we should point out that applying these remedies is anything but trivial. Using a sentence context to form a hypothesis about a novel word, for example, may be an instance of a general ability for extracting meaning from linguistic context, and this could be one of the things that separates good readers from poor ones.

Some General Comments about Comprehension Monitoring

One common reaction to proposals like the above is that too much comprehension monitoring can actually interfere with reading. Thus, in A Guide to Effective Study (1975), Locke writes:

In short, you need to monitor your mental processes while studying. This does not mean you should monitor every second; this would obviously make it impossible to learn the material. (p.126)

We have two reactions to this kind of argument. First, when it comes to reading deeply and analytically, we hold that monitoring is in fact needed all the time. Contrary to claims like Locke's, such constant monitoring will not interfere with learning once the monitoring is sufficiently well practiced so that it is automated and unconscious (see Adams, 1980). That is, the fallacy in the above claim lies in the hidden assumption that monitoring must go on consciously and hence usurp limited processing resources; in fact, it seems that some kinds of mental process that are practiced enough can become unconscious and automated, thereby not requiring resources that are in short supply (e.g., Schneider & Shiffrin, 1977). And comprehension monitoring may well be this kind of process.

But while we take issue with the claim that constant monitoring can impede learning, we recognize that there are numerous reading situations that do not require constant monitoring. Thus, if one is reading a text just to get the main points, one can probably safely ignore a novel word that

occurs in an unimportant sentence. More generally, different kinds of reading situations carry with them different criteria for comprehension, and the weaker the criterion (e.g., "just get the main point" vs. "be able to reproduce the arguments expositied"), the less the monitoring that may be needed (Baker, 1979b).

Hypothesis Generation, Evaluation, and Revision

In discussing comprehension monitoring, we mentioned the need to form tentative hypotheses about the meaning of a word or sentence. As they center on specific words and sentences, such hypotheses are very local. In the present section, we are concerned with far more general hypotheses, ones that are based on the characters' intentions and other global aspects of the text rather than on words and sentences.

As mentioned earlier, we distinguish between two basic kinds of hypotheses: predictions and interpretations. Predictions are hypotheses about what will happen, and interpretations are hypotheses about what is happening. Sometimes, as in character attributions described below, an interpretation is made (e.g., the hero is jealous) in order to make some prediction (e.g., he will try to outdo his rival). Both predictions and interpretations are often wrong, so the reader must look for further evidence and revise any predictions or interpretations that prove wrong.

Another way in which the hypotheses of present concern differ from those mentioned earlier is that the present ones are not triggered by comprehension failures. There is, however, an interplay between what was covered in the preceding section and the general hypotheses we consider here: to the extent students generate and test general hypotheses while reading, they may confront fewer comprehension failures. In some sense, then, the present section is concerned with preventing the kinds of problems that the prior section tried to remedy.

Table 2 shows our initial taxonomy of the kinds of general hypotheses students should learn to make as they read a text. We discuss each kind in turn.

a. Event Expectations

Expectations about future events occur mainly in fiction. We distinguish five major kinds of event expectations, the last three of which derive from Wilensky's (in press) analysis of stories:

- (1) Character attributions. Very commonly, authors create a set of expectations about what a particular character will do based on some attribution of a permanent character type (e.g., evil, jealous,

Table 2

Types of Hypotheses

1. Event Expectations

- a. Character attributions (permanent and temporary)
- b. Situational attributions
- c. Goal interaction between characters (competition and cooperation)
- d. Goal interactions within a character (conflict)
- e. Termination of a goal-subsumption state

2. Text Structure Expectations

- a. Structure of the genre
- b. Predictions from headings and titles

3. Interpretations

- a. Determining the main points
- b. Determining story themes
- c. Determining devices used by authors

impatient) or of a temporary state (e.g., grief or happiness). One of the most common character types with predictive expectations is the "bad guy." If someone is referred to as having a "curling lip" or a "jagged tooth," these are clues that the character plays the role of villain in the story, and therefore is likely to take some action against the central character.

(2) Situational attributions. Another source of expectations about future events is the specific situations that characters find themselves in. Regardless of their personality traits, we can expect most characters to be sad at a loved one's funeral, elated upon winning a valuable prize or award, conforming when confronted by a powerful authority, and so on. Recent experiments on story memory suggest that adult readers make extensive use of situational attributions (e.g., Bower, 1978).

(3) Goal interactions between characters. When two characters' goals come into conflict or when they come to share a common goal, expectations are created about how the characters will interact (Bruce & Newman, 1978; Wilensky, in press).

Conflict predicts various attempts to undermine the other character's ability to reach the goal or attempts to outdo the other character. Sharing goals predicts various kinds of helping.

(4) Goal interactions within a character. Often a character wants to pursue several goals that come into conflict, such as studying for an exam vs. having fun with the gang (Wilensky, in press). Such goal interactions lead to expectations about characters giving up something they want to do or ought to do, together with expectations about the consequences that flow from the particular choice (not studying can lead to failing a course, not getting into a good school or job, etc.).

(5) Termination of a goal-subsumption state. Wilensky (in press) also points out that termination of a goal-subsumption state often leads to expectations about a character's actions. A goal-subsumption state occurs when a person is in a state where a number of goals are satisfied automatically (e.g., the state of having a job can satisfy goals having to do with eating, recreation, and travel). When such a state terminates, the

character has to find a way to satisfy the goals that are no longer subsumed. Thus being married is a goal-subsumption state, and if a woman leaves her husband, we expect her to take actions to deal with whatever goals are no longer subsumed (e.g., finding a source of extra money, babysitting, companionship, etc.).

b. Text Structure Expectations

There are a number of expectations that derive from text structure per se rather than from the content of the text. We have not tried to enumerate all these structural expectations systematically but we can give a few examples of the kinds of predictions from text structure that students should learn to make:

(1) Structure of the genre. Both in stories and expository texts, there are standard structures that should create expectations in the reader. For example, a mystery story should lead one to look for clues as to who committed or will commit a crime. The clues often come in the form of extraneous details or discrepancies between what a character says and what one can infer must have been the case.

To give an example from expository literature, a standard form for presenting new material is what Armbruster & Anderson (1980) call the "Compare and Contrast" structure. When a new object is introduced by comparison to a known object, the reader should expect a point by point comparison of the similarities and differences between the two objects.

(2) Titles and headings. The titles and headings in a text usually provide a clue as to what will come next, particularly with respect to the main point of the succeeding text. Readers often ignore headings, and by doing so, they lose one of the main clues as to the high-level structure of the text. It is therefore important for teachers to stress the predictive and interpretive power of headings, even though they are sometimes misleading (Anderson, Armbruster, & Kantor, 1980).

c. Other Interpretive Skills

There are a number of other high-level interpretive skills that are currently emphasized in most reading curricula, which should be emphasized in any process-oriented

curriculum as well. The difference between our approach and that of most product-oriented curricula is that we emphasize the specific clues a reader can use to make interpretations. We will discuss three kinds of skills and their triggering cues as examples of what we have in mind.

(1) Determining the main points. There are a number of cues that signal when a particular idea is the main point of a paragraph or expository text. For example, if an idea is mentioned in a heading or opening sentence, it is likely to be a main point. Main points are also likely to be reiterated or marked by some verbal cue such as "Therefore," "The point is," or even "This is exemplified by," where the idea expanded upon is the main point. Students should learn to recognize these and other cues that authors use to signal main points.

(2) Determining story themes. Extracting the theme of a story is an important skill that is rarely taught directly. One aspect of it is to recognize the kinds of ideas that can function as story themes: for example, that "persistence pays off," or that "revenge may be sweet momentarily, but is costly in the long run." Students must learn to

extract the clues from the text that enable them to identify what the theme of a particular story is. Themes usually derive from the salient characteristics of the main characters and the central events they are involved in.

(3) Determining devices used by authors. One of the important aspects of writing is the devices authors use to create different effects on the reader: to catch their interest, create suspense, create a sense of danger or villainy, etc. (Collins & Gentner, in press). Students need to be able to recognize the clues for the various devices. For example, a sense of danger can be created by eerie sounds, unexplained events, etc. Detailed knowledge about how effects on readers are created is useful to the students both as readers and as writers.

Teaching Strategies

Our ultimate goals are to have students be vigilant for the various comprehension failures they might encounter during silent reading and to know how to remedy them, to actively hypothesize about what will happen next, and to recognize cues in the text that signal main points, themes, and narrative devices. It seems best, though, to approach these goals in

stages. Accordingly, the first stage will consist of the teacher modelling comprehension, commenting on his or her monitoring and hypotheses while reading aloud to a student. The next stage will consist of encouraging students to practice these techniques themselves while reading aloud. The third and final stage will be to have students use these skills while reading silently.

a. The Modelling Stage

The basic idea in the modelling stage is that the teacher reads a story or other text aloud, making comments while reading. In this stage, it is easiest if the teacher uses a longer text that is unfamiliar. As the text is being read, the teacher interrupts maybe once or twice a paragraph to make comments about all the different aspects of the comprehension processes discussed above. For example:

(1) Generating hypotheses about the text. The teacher should generate any hypothesis that comes to mind. The more wrong hypotheses (up to some point) the better, because the students must learn about hypothesis revision and that initial hypotheses are not always correct. It is also important for students to realize that it is okay to verbalize wrong hypotheses.

(2) Evidence supporting hypotheses. When a prediction is made, the teacher should mention the reasons for the prediction. It is particularly important to point out any evidence occurring later in the text that supports the hypothesis.

(3) Evidence against any hypothesis. When something happens in the text that disconfirms any hypothesis, the teacher should point this out. If it causes the teacher to revise the hypothesis, any revisions should be explained.

(4) Confusion or doubts on the part of the teacher. If the teacher does not understand a word, or how two events are related, etc., he or she should point out the confusion and explain the source of it. If it is a word or concept, then he or she might suggest any of the remedies we described earlier. If the teacher thinks the author is deliberately trying to mislead the reader (a narrative device used in numerous stories), this too should be pointed out. If the teacher thinks the confusion will be clarified later, he or she should point that out as well.

(5) Critical comments on text. If the teacher has any insights as to what the author is trying to do and how effectively he is doing it, he or she should point that out. Both favorable and unfavorable comments should be made.

Even in this first stage, the teacher should encourage the student's active participation. Thus the teacher can ask the student to generate hypotheses, e.g., "If Bill is really going swimming, what do you think he'll do next?" or "Does that sentence make sense to you?" The extent of the student's participation should gradually increase, thereby making the transition to the second stage a gradual one.

b. The Student Participation Stage

This stage can start out with questions suggesting hypotheses, "Do you think X is a bad guy?" or "Do you think X will do Y?" and move to more open ended questions, "What do you think will happen to X?" or "How do you think the story will end?" It is particularly important to reward students for generating their own hypotheses. One way to do this is to cite the evidence supporting their hypotheses. When evidence comes in that bears on any of the student's hypotheses, the teacher should always point that out.

With respect to comprehension monitoring, the teacher should gradually shift the major responsibility for spotting failures and generating remedies to the students. Initially, the teacher asks the students about things they may find confusing. Later, the teacher should serve mainly a corrective function, pointing out problems the student may have missed, suggesting possible remedies when none are forthcoming from the students, etc.

If the teacher encourages the students enough, they should be offering their predictions as freely as the teacher after a little while. It is important to get the dynamic going so that everyone has different ideas as to what may happen. Then reading becomes a game for the students, where they get to see who guessed right. Everybody in the group should make their own guesses. Then they have a stake in how the story turns out. This method effectively enhances the motivation in reading, as well as stresses the hypothesis formation and revision process.

c. The Read-Silently Stage

What we want to do here is encourage students to monitor comprehension and make predictions while reading silently. But of course we need some kind of output from students to see

how they are doing. One procedure for collecting output is to tell students there is something "wrong" with a piece of text and that they are to read it silently and then tell the tutor what the problem is. Though this procedure seems adequate for assessing students' ability to detect problems, it does not assess their use of remedies. To get at the latter, one can give students comprehension questions on texts (read silently) that are constructed to be difficult in various ways, where correct answers are likely only if the right remedies have been applied to problems in the text.

In order to get at student's ability to make predictions while reading silently, we can insert various questions at different points in a text that require predictions about what will happen next. The correctness of the answers will not be determined by what actually happens in the text, but by the reasonableness of the prediction at the point at which the prediction is made. If a multiple choice format is used, the alternatives should not always include what actually happens, so that the hypothesis revision process can be tapped with later questions. The texts involved can be constructed so as to provide examples of all the types of hypotheses we have discussed. Furthermore, each type of hypothesis should be used with very different texts -- stories, instructions, and

descriptions. This diversity of learning contexts is needed to insure that whatever skills are acquired will generalize to as wide a domain as possible.

Conclusion

Many reading curricula used in the schools do not try to teach the kind of comprehension monitoring and predictive skills that we have discussed. Instead the curricula emphasize the final interpretations a reader ends up with, from word and sentence meaning to author intentions and main points. This particular emphasis comes from trying to teach the product of reading (i.e., the interpretation) rather than the process of reading (i.e., the construction of an interpretation).

We do not argue that reading curricula should not stress interpretations. We argue only that a reading curriculum should also try to teach how to construct interpretations: that comprehension monitoring and hypothesis testing are necessary to the development of skilled reading. If we do not teach these skills, then the better students will develop them on their own, and the worse students will find reading very frustrating.

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